Reprinted from: Perspectives on new crops and new uses. 1999.
J. Janick (ed.), ASHS Press, Alexandria, VA.

Cucurbit Resources in Namibia*

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Namibia has several cucurbits with potential for development into commercial crops either through selection or through the introduction of genes into known crops. *Acanthosicyos horrida* Welw. ex J.D. Hook., wild *Citrullus ecirrhosus* Cogn., and *C. lanatus* (Thunb.) Matsum. & Nakai in the Cucurbitaceae are examples of gene sources. The areas from which these plants come are arid and the plants derive their water needs from dew precipitation in the mornings, very occasional rains every few years, and deep ground water (Seely l987; Lovegrove 1993).

ACANTHOSICYOS HORRIDA

Acanthosicyos horrida forms clumps of vegetation in the dunes of the Sossuvlei region near Walvis Bay (Fig. 1) (Craven and Marais 1986; Lovegrove 1993; Klopatek and Stock 1994). *Acanthosicyos horrida is* a dioecious perennial cucurbit attaining a height of about 1.5 m (Fig. 2). It forms plants of one sex in single clumps which may touch plants of the same or other sex nearby (Fig. l). It bears deep water table seeking roots (G. Wardell–Johnson, pers. commun. 1998). The plants are totally leafless (Fig. 2) and have a fruiting habit of oblong spherical fruits reaching up to 25 cm average diameter. The plants are able to build up sand deposits around themselves and continuously grow to be above these sand deposits. New plants establish only when rain falls and quickly form deeply growing roots that seek the water table (G. Wardell–Johnson, pers. commun. 1998).

The fruit may not be spaced apart and may occur in clusters of several touching each other. The fruits are spiny (Fig. 3). Maturation of the fruits occurs between February and April. The fruits do not change color and remain green on the outside but the flesh surrounding the seeds dissociates from the skin, turns orange in color (Fig. 4), extremely sweet in taste and strongly aromatic. Maturational changes are easily detected by the bushmen living in the area without breaking the fruit in any way. The fruits are used by the bushmen for two main purposes. The first is for the extraction of the seed which are consumed as pips by splitting in the mouth and the second is for pulp processing where the flesh is boiled and poured to form a fruit leather. This fruit leather is eaten throughout the year and is considerably less flavorful than the pulp. The plant thus forms an important food resource because of the easy storage of both the seeds and the dried pulp (leather). The fruits are eaten also when immature by animals including jackals and rodents who do not seem to be bothered by the bitter taste of the fruits caused by cucurbitacins (Hylands and Magd 1986).

The mature pulp has a flavor which is aromatic and maybe due in part to sulphur components as in some types of C*ucumis melo* L. No trace can be tasted of cucurbitacins in the mature pulp. The pulp could be commercialized and used to make ice-cream, and could be freeze dried and chocolate coated. The seeds which are already sold to an European population in Walvis Bay can have their market expanded by selling the seeds either whole or dehusked in packaging developed for nuts. Their rarity should provide a premium price and help the economic existence of the bushmen in this area. Ice-cream manufacture and freeze drying facilities are only within 30 km of the bushmen. Partnerships with firms interested in commericalizing the unique, aromatic pulp of *Acanthosicyos horrida* could be fostered to further improve the economic existence of the native people in the area.

CITRULLUS ECIRRHOSUS

Citrullus ecirrhosus is a desert perennial (Fig. 5, 6) which is monoecious. Fruits mature (Fig. 7, 8) February to March. The leaves form an annual stems which die back each year. The leaves have a special feature where the lamina is curved over the mid-rib and the lateral veins so that when viewed from above the top surface is only visible in the vein regions and the leaves have a greenish white appearance due to the lower epidermis being reflected up as the upper surface of the leaf. This lower epidermis is covered with warts and hairs which account for the whitening effect. Both lower and upper epidermis contain similar amounts of

*This project was supported by the Centre for Microscopy and Microanalysis, The University of Queensland and the Centre for Horticulture and Plant Sciences, University of Western Sydney, Hawkesbury.

Fig. 1. View of *Acanthosicyos horrida* in sand dunes at the Sossuvlei region near Walvis Bay Namibia.

Fig. 2. A close up of *Acanthosicyos horrida* plants. Note the leaflessness.

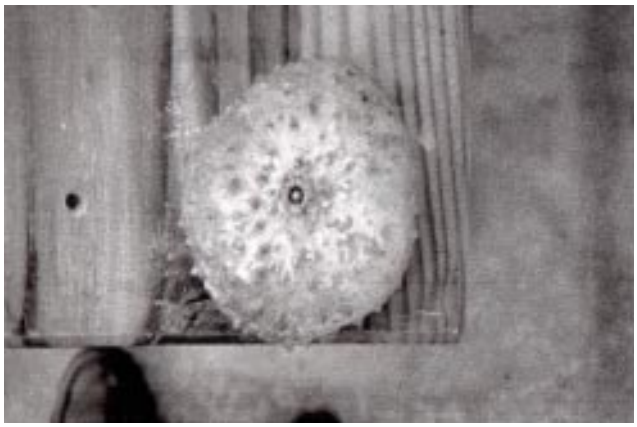

Fig. 3. Back of a mature fruit of *Acanthosicyos horrida* showing the large spines on the surface of the fruit. The distances separating the spines are small in young fruits.

Fig. 4. Cross section through three fruits of *Acanthosicyos horrida*. The one on the extreme right is a bitter immature fruit of full size. The one on the top an almost mature fruit with only a little bitterness. The bottom left hand fruit a fully mature fruit with a flesh having an orange color, no bitterness and very aromatic in flavor.

Fig. 5. *Citrullus ecirrhosus* perennial plant growing approximately 20 km inland from Walvis Bay, showing a mature fruit on current years growth and brown dead stems from last years growth.

Fig. 6. *Citrullus ecirrhosus* perennial plant showing young developing fruit in the foreground and the bending of the leaves over the mid-rib and lateral veins.

Fig. 7. Mature *Citrullus ecirrhosus* showing folded nature of the leaves of the mid-rib and lateral veins.

Fig. 8. Fruit of *Citrullus ecirrhosus* cut showing white creamy flesh which is non juicy and brown seeds.

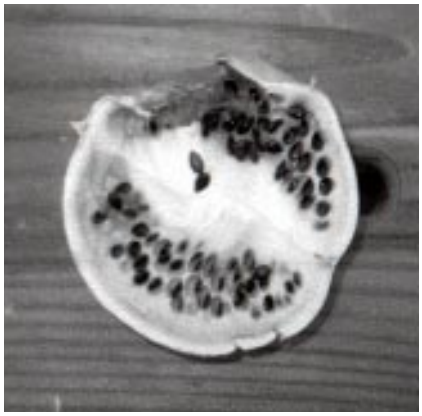

Fig. 9. *Citrullus lanatus* mature fruit from a plant growing on a dry river bed approximately 20 km inland from Walvis Bay, cut to show chlorophyll in the flesh and browny-black seeds. The more deeply colored regions of the flesh are green. The flesh is more juicy than in *Citrullus ecirrhosus.*

stomata. The water relations of this plant are reliant on a deep water layer in the ground which the roots reach and possibly some water availability from morning fogs and the very occasional rainfall. The fruit and seeds contain cucurbitacins but the seeds are harvested in times of need and processed by crushing and decantation to remove the bitter substances. *Citrulls ecirrhosus* plants may be a source of drought tolerance genes for *Citrulls lanatus.* Successful crossability of *Citrulls ecirrhosus* and *C. lanatus* is discussed in Navot and Zamir (1986) and Navot et al. (1990). They have shown the way for breeding C*itrullus lanatus* containing genes from *C. ecirrhosus.*

CITRULLUS LANATUS

Citrullus lanatus wild plants seen near Walvis Bay have green fleshed fruit unknown from domesticated watermelons (Fig. 9). The genetics of fruit color in the watermelon, *Citrullus colocynthis* and *ecirrhosus* are discussed by Navot et al. (1990). White, yellow, orange, pink, red, and crimson flesh types are known. The green flesh color of this wild *Citrullus lanatus* (Fig. 9) is a unique feature which can be transferred to domestic watermelon due to the crossability of wild and domestic watermelons. This would offer a new fruit type for consumers to enjoy. A red flesh cultivated watermelon from the north of Namibia has some green zone within the fruit suggesting that the green flesh character can be easily introduced. However, the wild watermelon has cucurbitacins which would render them unfit for human consumption. Drought tolerance and green flesh color from *C. ecirrhosus* and wild C*itrullus lanatus,* could be valiable traits for watermelon improvement.

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